

Amendments to the Specification

Please insert the following new paragraph on page 1 before line 4.

This application is a division of Application No. 10/080,677 filed February 25, 2002.

The paragraph starting at page 1, line 18 has been amended as follows.

Known recording apparatuses having a function of a printer, a copying machine, a facsimile machine, or the like, and known recording apparatuses employed as output devices of combined type electronic apparatuses including computers and word processors are constituted to form a desired images on a recording medium in accordance with image information. The ink-jet recording apparatus is one of such recording apparatuses. The ink-jet recording apparatus conducts recording by ejecting an ink from a recording head onto a recording medium in accordance with image information. The ink-jet recording apparatus has advantages of compactness of the recording head, high speed of recording with high fineness of recorded images, needlessness of special treatment of printing paper, low running cost, low noise generation, ease of full color image recording with multiple color inks, and so forth.

The paragraph starting at page 2, line 9 has been amended as follows.

In recording with the aforementioned ink-jet recording apparatus, the image is not usually formed on the peripheral area of the recording medium. For example as shown in Fig. 7, the image is usually formed in the image formation area 50, but is not formed in the peripheral area 51 of the recording medium. The ink-jet Ink-jet recording has been widely popularized, and is employed in recording on various recording medium media for various purposes. Consequently, the ink-jet recording is employed occasionally in "margin-free recording" which records images on a peripheral area of the recording medium including its edge.

The paragraph starting at page 2, line 21 has been amended as follows.

In the margin-free recording by an ink-jet system with a liquid ink such as an aqueous dye ink or an aqueous pigment ink, the ink adhered to an ink-absorbing member provided on a platen is liable to stain the reverse face of the recording medium. Moreover, in the margin-free recording, the recording medium such as a paper sheet is liable to jam to cause sheet delivery failure. Therefore, various techniques are disclosed for practicing the margin-free recording. For example, Japanese Patent Application Laid-Open No. 10-128964 discloses an ink-jet recording apparatus which comprises a guiding means and an ink-receiving means: the guiding means being provided inside the edges of the recording medium sheet so as to be movable in accordance of with the size of the recording medium in the direction perpendicular to the recording medium delivery direction, and the ink-receiving means for receiving the ink from the recording head being provided in

adjacency adjacent to the guiding means outside the direction perpendicular to the recording medium delivery direction.

The paragraph starting at page 3, line 15 has been amended as follows.

Japanese Patent Application Laid-Open No. 11-227229 discloses a selective use of a pigment ink and a dye ink according to the type of the recording paper sheet and the type of the image to be recorded. In the known jet printing systems, the selective use of the inks according to the type of recording paper sheets and of the images ~~are is~~ frequently employed in black color expression. In these systems, the recording is conducted by selecting a suitable ink for the recording medium and the type of image ~~with from among~~ a low-penetrable pigment ink, a high-penetrable dye ink, ~~or and~~ a so-called process black (hereinafter referred to as "PCBk"). For example, for printing black letters on a plain paper sheet, a low-penetrable black pigment ink is selectively used, or a high-penetrable dye ink is firstly applied and thereon the low-penetrable black pigment ink is applied. For printing images of black letters on a an ink-jet printing paper sheet, a high-penetrable dye ink is selected. For printing a landscape or a portrait other than letters, a black ink is used for UCR (under color removal) in a high-density portion, or a process black is used on a low-density non-colored portion in place of the black ink. However, these methods select the ink depending on the type of the recording paper sheet or the type of the image to be formed, but do not select the ink depending on the image formation area of a recording medium.

The paragraph starting at page 5, line 19 has been amended as follows.

The present invention intends to provide an ink-jet recording apparatus which is capable of recording a satisfactory image even in margin-free recording in which recording is conducted in the peripheral area of the recording medium including the edge thereof, similarly as in usual image formation in which an image is not formed on the periphery portion of the recording medium. The present invention also intends to provide an ink-jet recording process by use of the above ink-jet recording apparatus.

The paragraph starting at page 6, line 25 has been amended as follows.

According to another aspect of the invention, there is provided an ink-jet recording process comprising at least one of the steps of: (i) applying a low-penetrable ink which tends to accumulate an ink component on an ink-absorbing member; and (ii) applying a high-penetrable ink which less tends to accumulate an ink component on the ink-absorbing member, wherein an image is formed by controlling the process so as to use only the step (i) (ii) when forming an image even in a peripheral area of a recording medium including the edge thereof.

The paragraph starting at page 8, line 24 has been amended as follows.

According to another aspect of the invention, there is provided a process for forming an image on a recording medium with a reaction product of an ink and a liquid composition that reacts with the ink when coming into contact with the ink, comprising steps of:

(i) applying the ink to the recording medium, and
(ii) applying a prescribed amount of the liquid composition to the recording medium, the step (ii) being conducted so as to form at least the reaction product of the ink and the liquid composition on the recording medium, wherein the process further comprises a controlling step to apply the liquid composition to a peripheral area of the recording medium including the edge ~~thereof~~ in thereof in step (ii) in an amount smaller than the prescribed amount when forming the image even on the peripheral area.

The paragraph starting at page 9, line 20 has been amended as follows.

Fig. 3 is a sectional view of the recording apparatus of the present invention.

The paragraph starting at page 13, line 27 has been amended as follows.

Immediately after the landing of the ink droplets onto the surface of the recording medium, ~~the~~ most of the ink droplets ~~is~~ are absorbed ~~at~~ by the unevenness of the surface (roughness of the recording medium), and only a very small portion penetrates into

the recording medium. In the above equation, the time before beginning of the penetration is represented by t_w (contact time), and the absorbed amount at the hollow-protrusion is represented by V_r . After lapse of time t_w , the amount of the penetration increases in proportion to the square root of the time ($t-t_w$). K_a is the proportion coefficient for the increase of the penetration amount, corresponding to the penetration speed.

The paragraph starting at page 17, line 14 has been amended as follows.

The ink-jet recording apparatus of the present invention employs a low-penetrable ink which has a low penetrability and tends to accumulate an ink component on an ink-absorbing member, and a high-penetrable ink which less tends to accumulate an ink component on the ink-absorbing member, the apparatus being controlled to use only the high-penetrable ink without using the low-penetrable ink when ~~concluding~~ conducting the margin-free printing therefor. In another embodiment of the present invention, in the case of the margin-free recording, the ink-jet recording apparatus is controlled to gradually decrease the amount of application of the low-penetrable ink and to gradually increase the amount of application of the high-penetrable ink toward the edge of the recording medium, being which is different from the above embodiment using no low-penetrable ink.

The paragraph starting at page 18, line 7 has been amended as follows.

With the ink-jet recording apparatus of this example, the margin-free recording was conducted by controlling the system to use only a high-penetrable ink and not to use a low-penetrable ink when conducting the margin-free recording, causing no stain on the recording medium or no paper jamming to achieve excellent margin-free printing. The ink-jet recording apparatus of this example forms an image according to the flow chart shown in Fig. 1. Before starting the ink-jet recording, judgement should be made whether or not margin-free recording is to be conducted to record an image on the peripheral area of the recording medium including the edge thereof. The recording apparatus is constituted to receive the information thereon to decide the use or non-use of the low-penetrable ink, which is liable to accumulate on the ink-absorbing member.

The paragraph starting at page 18, line 24 has been amended as follows.

Fig. 1 is a flow chart of the operation of the ink-jet recording apparatus of this example. The operation of the ink-jet recording apparatus of this example is explained by reference to this flow chart. Firstly, the information on whether the image to be formed is margin-free or normal is obtained (S2). From this information, it is judged whether the margin-free recording or the normal recording is to be conducted (S3). In the case where the margin-free recording is judged not to be conducted, normal recording is conducted with a pigment ink and a dye ink in combination (S4). On the other hand, in the case where the margin-free recording is judged to be conducted, the information on the type of a recording medium (recording paper sheet) is obtained (S6). Then use or non-use of a

pigment ink is decided therefrom (S7). When the pigment ink is judged not to be used, normal recording is conducted with ~~a~~ only a dye ink (S8). On the other hand, when the pigment ink is judged to be used, the kind of the ink is changed to a dye ink solely (S10), and recording data is prepared according to this setting (S11) to conduct recording with the dye ink (S12).

The paragraph starting at page 20, line 9 has been amended as follows.

Fig. 3 is a sectional view showing the function of the recording part of the ink-jet recording apparatus of this example. In Fig. 3 the numerals therein ~~indicates~~ indicate the respective members as follows: 10, a recording paper sheet path; 11, a paper sheet sensor; 12, a pinch roller; 13, a delivery roller; 14, a nozzle region of head 1, namely a head recording region; 15, the center position of the head recording region; 16, a platen; 17, an ink-absorbing member placed on the platen 16; 18, a spur; and 19, a paper sheet discharging roller.

The paragraph starting at page 20, line 20 has been amended as follows.

In margin-free recording, the recording is conducted ~~to~~ on the peripheral area of the recording paper sheet satisfactorily as below. The recording paper sheet is delivered through a paper sheet path 10 to the recording apparatus. A paper sheet sensor 11 detects the position of the front edge of the recording paper sheet. Thereby, the front

edge of the recording paper sheet is delivered to the center position 15 of the head recording region. There, recording is conducted by the ink-jet recording head 1 on the recording paper sheet being fed at a prescribed feeding rate. After detection of the rear edge of the recording paper sheet by the paper sheet sensor, the recording on the rear edge of the recording paper sheet is conducted by positioning the rear end portion of the recording paper sheet in the head recording region 14.

The paragraph starting at page 21, line 10 has been amended as follows.

In this example, in margin-free recording, a low-penetrable ink and a high-penetrable ink are combinedly used in recording in the peripheral area of the recording medium. This is different from Example 1 in which the low-penetrable ink is not used at all. In this Example 2, as described below, the ink-jet recording apparatus is controlled, for image formation in the peripheral area of a recording medium, to gradually decrease the amount of application of the low-penetrable ink and to gradually increase the amount of application of the high-penetrable ink toward the edge of the recording medium. Thereby, the margin-free recording could be successfully conducted similarly as in Example 1 without causing staining on the reverse face or jamming of the recording medium.

The paragraph starting at page 21, line 25 has been amended as follows.

The steps of image formation in this example are explained by reference to Figs. 6, 7, 8A and 8B. As shown in Fig. 6, firstly, the information on whether the image to be formed is margin-free or normal is obtained to (S2). From this information, it is judged whether the margin-free recording or the normal recording is to be conducted (S3). In the case where the margin-free recording is judged not to be conducted, normal recording is conducted with a pigment ink and a dye ink in combination (S4). On the other hand, in the case where the margin-free recording is judged to be conducted, the information on the type of a recording medium (recording paper sheet) is inputted (S6). Then use or non-use of a pigment ink is decided (S7). When the pigment ink is judged not to be used, normal recording is conducted with a only a dye ink (S8). On the other hand, when the pigment ink is judged to be used in the recording, data for ink-jet recording for the peripheral area including the edge of the recording paper sheet is prepared according to the setting for the system (S10), and recording is conducted by combined use of a pigment ink and a dye ink (S11).

The paragraph starting at page 25, line 15 has been amended as follows.

Fig. 9 shows nozzle rows 101-104 of a recording head: nozzles of row 101 for a black pigment ink, nozzles of row 102 for a cyan dye ink, nozzles of row 103 for a magenta dye ink, and nozzles of row 104 for a yellow dye ink. With such a nozzles, for the area where a black pigment ink is judged not to be used, a black image is formed by a

process black which is obtained by suitably mixing a cyan dye ink, a magenta dye ink, and a yellow dye ink.

The paragraph starting at page 27, line 10 has been amended as follows.

The present invention is also effectively applicable to an ink-jet recording apparatus and ink-jet recording method which employs employ an ink and a liquid composition that reacts with the ink when coming into contact therewith to form a reaction product (hereinafter referred to simply as a "liquid composition") to conduct recording with the reaction product of the ink and the liquid composition. In such a recording method, for example, an aqueous ink is mixed with an aqueous liquid composition to cause reaction to form a reaction product, such as ~~an~~ agglomerate particles of the colorant component of the ink, thereby forming an image with the agglomerate particles. This method prevents the colorant of the ink from excessive penetration into the recording medium, thereby giving a recorded product having excellent color tone and high water-resistance. Such a recording method itself is known as is disclosed in Japanese Patent Application Laid-Open No. 10-95107, etc. However, in the cases where such a recording method is employed for recording on a peripheral area of the recording medium including the edge thereof, it is expected to bring about the same problem as that caused by the aforementioned low-penetrable ink. Therefore, in recording on a peripheral area including the edge of the recording medium with the ink-jet recording system with the reaction product of the ink colorant and the liquid composition capable of reacting with the colorant to form

agglomerate particles of the colorant, the system is controlled to use only the ink for recording in the peripheral area without using the liquid composition. Thereby the aforementioned problem that the ink component accumulates on the ink-absorbing member on the platen can be solved, and as a result the staining and delivery failure of the recording medium are suppressed effectively.